

518 Rec'd PCT/PTO C 6 AUG 2001

FORM PTO 1390
(REV. 5-93)

U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

TRANSMITTAL LETTER TO THE UNITED STATES
DESIGNATED/ELECTED OFFICE (DO/EO/US)
CONCERNING A FILING UNDER 35 U.S.C. 371ATTORNEY DOCKET NUMBER
99920P (4497-40)

U.S. APPLICATION NO (if known, see 37 CFR 1.5)

09/890828

INTERNATIONAL APPLICATION NO.
PCT/US00/32933INTERNATIONAL FILING DATE
5 December 2000PRIORITY DATE CLAIMED
7 December 1999TITLE OF INVENTION
HEAT BRIDGES FOR ELECTRIC MOTOR WITH GEAR CASEAPPLICANT(S) FOR DO/EO/US
Kenneth N. WHALEY

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(I).
4. ☐ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of the International Application as filed (35 U.S.C. 371(c)(2))
 - a. ☐ is transmitted herewith (required only if not transmitted by the International Bureau).
 - b. ☐ has been transmitted by the International Bureau.
 - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☐ A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. ☐ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
 - a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
 - b. ☐ have been transmitted by the International Bureau.
 - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
 - d. ☐ have not been made and will not be made.
8. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11. to 16. Below concern other document(s) or information included:

11. ☐ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. ☒ A **FIRST** preliminary amendment.
☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.
14. ☐ A substitute specification.
15. ☐ A change of power of attorney and/or address letter.
16. ☐ Other items or information:

U.S. APPLICATION NO. (if known, see 37 CFR 1.5) <div style="font-size: 1.5em; font-weight: bold;">09/890828</div>		INTERNATIONAL APPLICATION NO. PCT/US00/32933		ATTORNEY'S DOCKET NUMBER 99920P (4497-40)	
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17.	The following fees are submitted: Basic National Fee (37 CFR 1.492(a)(1)-(5)): Search Report has been prepared by the EPO or JPO..... \$ 840.00 International preliminary examination fee paid to USPTO (37 CFR 1.482)... \$ 670.00 No international preliminary examination fee paid to USPTO (37 CFR 1.482) but international search fee paid to USPTO (37 CFR 1.445(a)(2))..... \$ 760.00 Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO..... \$ 970.00 International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4)..... \$ 96.00 <div style="text-align: center;">ENTER APPROPRIATE BASIC FEE AMOUNT =</div>	\$840.00	
Surcharge of \$130.00 for furnishing the National fee or oath or declaration later than <input type="checkbox"/> 20 30 Months from the earliest claimed priority date (37 C.F.R. 1.491(3)).		+	
Claims	Number Filed	Number Extra	Rate
Total Claims	12 - 20 =	0	x \$ 18.00
Independent Claims	2 - 3 =	0	x \$ 80.00
Multiple dependent claim(s) (if applicable)		+ \$260.00	0.00
TOTAL OF ABOVE CALCULATIONS =			\$0.00
Reduction by 1/2 for filing by small entity, if applicable. Verified Small Entity statement must also be filed. (Note 37 C.F.R. 1.9, 1.27, 1.28).			\$ 0.00
SUBTOTAL =			\$840.00
Processing fee of \$130.00 for furnishing the English Translation later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 C.F.R. 1.492(f)).			
TOTAL NATIONAL FEE =			\$840.00
Fee for recording the enclosed assignment (37 C.F.R. 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 C.F.R. 3.28, 3.31). \$40.00 per property +			
TOTAL FEES ENCLOSED =			\$840.00
			Amount to be
			Charged:

a. ☒ A check enclosed in the amount of \$840.00 to cover the above fees is enclosed.

b. ☐ Please charge my Deposit Account No. 01.2000 in the amount of \$_____ to cover the above fees. A duplicate copy of this sheet is enclosed.

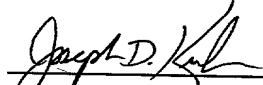
c. ☐ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 01.2000. A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO: ANDRUS, SCEALES, STARKE & SAWALL, LLP

100 East Wisconsin Avenue, Suite 1100

Milwaukee, Wisconsin 53202


 Signature

8/6/01
 Date

Joseph D. Kuborn
 Name

40,689
 Reg. No.

JC05 Rec'd PCT/PTO 0 6 AUG 2001

U.S. APPLICATION NO. (if known, see 37 CFR 1.5) 09/890828	INTERNATIONAL APPLICATION NO. PCT/US00/32933	ATTORNEY'S DOCKET NUMBER 99920P (4497-40)
CERTIFICATE OF EXPRESS MAIL		
I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as EXPRESS MAIL-POST OFFICE TO ADDRESSEE, in an envelope addressed to: BOX PCT, COMMISSIONER OF PATENTS AND TRADEMARKS, WASHINGTON, D.C. 20231 on the <u>6th</u> day of August, 2001. Express Mail Label <u>EL 812750723US</u> .		
<u>Veronica K. Haupt</u> Veronica K. Haupt		<u>8-6-01</u> Date

09890828 080601

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application of)	Group Art Unit:
)	
KENNETH N. WHALEY)	Examiner:
)	
Int'l. Serial No. PCT/US00/32933)	Heat Bridges For Electric Motor
)	With Gear Case
Int'l. Filing Date: 05 December 2000)	

PRELIMINARY AMENDMENT

Box PCT Application
Commissioner for Patents
Washington, D.C. 20231

Sir:

It is requested that U.S. national stage examination be carried out on the enclosed application. Prior to computing the filing fee in this application, kindly amend the above identified application, as follows.

IN THE SPECIFICATION:

In the specification, after the title, please insert the following:

---CROSS-REFERENCE TO RELATED APPLICATION

The present invention is based on and claims priority to U.S. Provisional Patent Application Serial No. 60/169,542 filed on December 7, 1999 and is a national stage application of PCT International Application No. PCT/US00/32933 published in English on June 14, 2001 as Publication No. WO 01/43260.---

Applicant: Kenneth N. Whaley

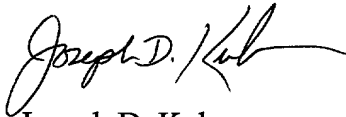
Attorney Docket No. 99920P (4497-40)

IN THE ABSTRACT:

Cancel the Abstract presently in the application and substitute therefor the Abstract attached to this Preliminary Amendment.

Respectfully submitted,

ANDRUS, SCEALES, STARKE & SAWALL, LLP




Joseph D. Kuborn
Reg. No. 40,689

100 East Wisconsin Avenue, Suite 1100
Milwaukee, Wisconsin 53202
(414) 271-7590
Atty. Docket No. 99920P (4497-40)

CERTIFICATE OF EXPRESS MAIL

I hereby certify that this correspondence is being deposited with the United States Postal Service, with sufficient postage, as EXPRESS MAIL - POST OFFICE ADDRESSEE, in an envelope addressed to: Box PCT Application, Commissioner for Patents, Washington, D.C. 20231 on this 6th day of August, 2001. The Express Label is EL812750723US.


Veronica K. Haupt

8-6-01
Date

ABSTRACT

A method and apparatus for dissipating heat from electric motors.

Small electric motors often operate at undesirably high temperatures and are often mounted to gear cases. To reduce the temperature a thermally conductive gap

- 5 filling material is compressed between the winding heads of the stator and the mating surface of motor and gear case. The gear case functions as a heat sink for the stator windings. Additional heat sinks may be mounted on the motor housing using additional thermally conductive gap filling material compressed between the other winding heads and the cover.

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HEAT BRIDGES FOR ELECTRIC MOTOR WITH A GEAR CASE

CROSS-REFERENCES TO RELATED APPLICATIONS

- This application is a continuation in part of U.S. Provisional Application No.
- 5 60/169,542 filed on December 7, 1999, which is herein incorporated by reference.

TECHNICAL FIELD

The present invention relates to electric motor systems and more particularly to heat transfer methods in electric motor systems.

10

BACKGROUND ART

- In a large number of electric motor applications, it is desirable to minimize heat retained in an electric motor. Maximum temperature rise specifications are prescribed for many applications by government and private regulatory agencies.
- 15 Agencies such as Underwriters Laboratories specify maximum temperature rise limits for product applications as a requirement for agency listing or recognition of a product. Many consumer product manufacturers will not purchase components or products that are not listed or recognized by specific agencies, particularly Underwriters Laboratories. Therefore, the market viability of many products
- 20 depends on the product's compliance with Underwriters Laboratory requirements.

It is known that smaller electric motors typically run hotter than larger motors in specific applications. Accordingly, it is known to provide a larger motor or a motor having a higher performance where applications using a smaller motor

or a motor having lower performance fails to comply with heat rise specifications.

For example, in the medical equipment industry, it is known that certain small motors have been heretofore unsuitable for use in hospital type beds and

assisted chairs because the small motors fail to meet relatively low, for example

5 100°C, Underwriters Laboratory heat rise requirement. It is known to employ larger or higher performance motors that run cooler in such applications in order to meet the Underwriters Laboratory temperature rise requirement. Such larger or higher performance motors are typically more expensive than smaller or lower performance motors.

10 It is known to provide heat sink components to radiate excess heat generated by many electronic and mechanical devices. Such heat sink components typically comprise a large surface area that is mounted directly against a surface area of a device to maximize heat transfer from the device to the heat sink. It is common practice in the electronic industry to provide a
15 compliant gap filling substance between heat sink components and the device to which the heat sink is mounted to further promote heat transfer away from the device.

DISCLOSURE OF THE INVENTION

20 Accordingly, it is a primary advantage of the present invention to provide an improved method of heat transfer in electric motors by employing a thermally conductive gap filler between a motor windings end surface and a mating surface

of a gear case. The method of the invention allows improved heat transfer away from the motor coils and allows a gear case to function as a heat sink.

An additional heat sink which may be mounted to an opposite end of a motor similarly using a thermally conductive gap filler between the heat sink and the motor windings surface provides additional heat transfer away from the motor. Additional heat transfer can be accomplished through the addition of a conductive gap filler. A conductive gap filler "liquid form heat transfer compound" is placed into the gap between the motor and the motor lamination stack.

The heat transfer method of the present invention provides sufficient additional cooling to an electric motor so that a small or low performance inexpensive motor complies with the Underwriters Laboratory heat rise specification for use in hospital type beds and assisted chairs.

It is to be understood that various changes can be made by one skilled in the art in one or more of the several parts of the invention described herein without departing from the scope of the invention.

BRIEF DESCRIPTION OF DRAWINGS

FIG. 1 is a side section view of a gear case of at least one embodiment of the present invention.

FIG. 2 is a front plan view of a gear case of at least one embodiment of the present invention.

FIG. 3 is a side section view of a motor and gear case of at least one embodiment of the present invention including a heat sink and two thermal pads.

FIG. 4 is a plan view of a thermal pack according to at least one embodiment of the present invention.

FIG. 5 is a side view of a thermal; pad according to at least one embodiment of the present invention.

5

MODES FOR CARRYING OUT THE INVENTION

Referring to FIG. 1 that discloses a sectioned side view of a gear case 24 according to the present invention, a gap pad area 20 can be seen within a motor mounting area 22 which is capable of receiving one end of an electric motor where motor windings of the electric motor contact the gear case and a gap pad. Referring to FIG. 2, a front view of the gap pad area 20 and motor mounting area 22 of a gear case according to at least one embodiment of the present invention can be seen.

Referring to FIG. 3 which discloses a sectioned side view of an electric motor 30, two gap pads 26, 32 and a heat sink 34 according to at least one embodiment of the present invention: a first gap pad 26 can be seen installed between the gear case 24 and a first windings end 28 of an electric motor 30. Further displayed in FIG. 3 is a motor gap 40 that is optionally filled with liquid conductive gap filler forming an intimate contact with the motor and the lamination stack further enhancing heat transfer.

A front view of a gap pad 26, 32 according to at least one embodiment of the present invention is show in FIG. 4. A side view of a gap pad 26, 32 according to at least one embodiment of the present invention is shown in FIG. 5. In the

preferred embodiment each gap pad comprises a high performance thermally
conductive gap filling material with a thermal conductivity rate at 10 psi of about
3.0 W/m-K. A specific preferred material is supplied by the Bergquist Company
and referred to by the trade name Gap Pad ' 3000. The gap pads as used in a
5 preferred embodiment of the present invention have a thickness 36 of about 125
inches.

Mechanical fasteners, typically bolts, secure a motor 30 to a gear case 24
and compress a gap pad 26 in the gap pad area 20 so that a maximum thermal
surface is maintained between the motor first windings end surface 28 and the
10 gear case 24.

A heat sink 34 may be secured to a motor second end surface 38 whereby
a second gap pad 32 is compressed in a second gap pad area between the heat
sink 34 and the motor second windings end surface 38 so that a maximum
thermal surface is maintained to facilitate a maximum heat flow between the
15 motor second end and the heat sink 34.

The preferred embodiment of the invention employs a permanent split
capacitor motor for application with a gear case to operate hospital type beds and
assisted chairs. However the heat transfer method of the invention may be
applied to any number of motor designs and applications.

20 Having thus described my invention, what I claim as new and desire to
secure by United States Letters Patent is:

I claim:

1. A mechanical drive apparatus comprising:

at least one electric motor having a first winding end surface and a second winding end surface;

a gear case having gears wherein at least one said electric motor provides rotation to said gears and having a mating area wherein said mating area is affixed to said first windings end surface;

a first gap pad space between said first windings end surface and said mating area;

a first gap pad comprised of thermally conductive gap filling material in said first gap pad space and compressed between said first windings end surface and said mating area.

2. The mechanical drive apparatus according to claim 1 further comprising:

a heat sink having a mating area capable of accepting said second windings end surface and matingly attached thereto;

a second gap pad space between said heat sink mating area and said second windings end surface;

a second gap pad comprised of thermally conductive gap filling material in said second gap pad space and compressed between said heat sink mating area and said second windings end surface.

3. The mechanical drive apparatus according to claim 1 wherein said thermally conductive gap filling material is a compliant polymer of high thermal conductivity.
4. The mechanical drive apparatus according to claim 1 wherein said thermally conductive gap filling material is a Bergquist Gap Pad Tm 3000.
5. A mechanical drive apparatus according to claim 4 wherein said thermally gap filling material has a thickness of 0.125 inches.
6. A method of reducing temperature rise in electric motor / gear case applications comprising:
- providing a thermally conductive gap filling material in compression between a first windings end surface of an electric motor and a mating surface of a gear case.
7. The method according to claim 6 further comprising:
- providing a thermally conductive gap filling material between a second windings end surface of an electric motor and a mating surface of a heat sink.
8. The method according to claim 7 wherein said thermally conductive gap filling material comprises a compliant polymer of high thermal conductivity.

9. The method according to claim 7 wherein said thermally conductive gap filling material is a Bergquist Gap Pad ' 3000.
10. The method according to claim 9 wherein said conductive gap filling material is 0.125 inches thick.
11. The mechanical drive apparatus according to claim 1 further comprising
- a liquid heat transfer compound;
 - a motor lamination stack wherein said liquid heat transfer compound is in intimate thermal communication between said motor and said motor lamination stack.
12. The method according to claim 6 further comprising:
- pouring a liquid form heat transfer compound into the gap between the motor and the motor lamination stack.

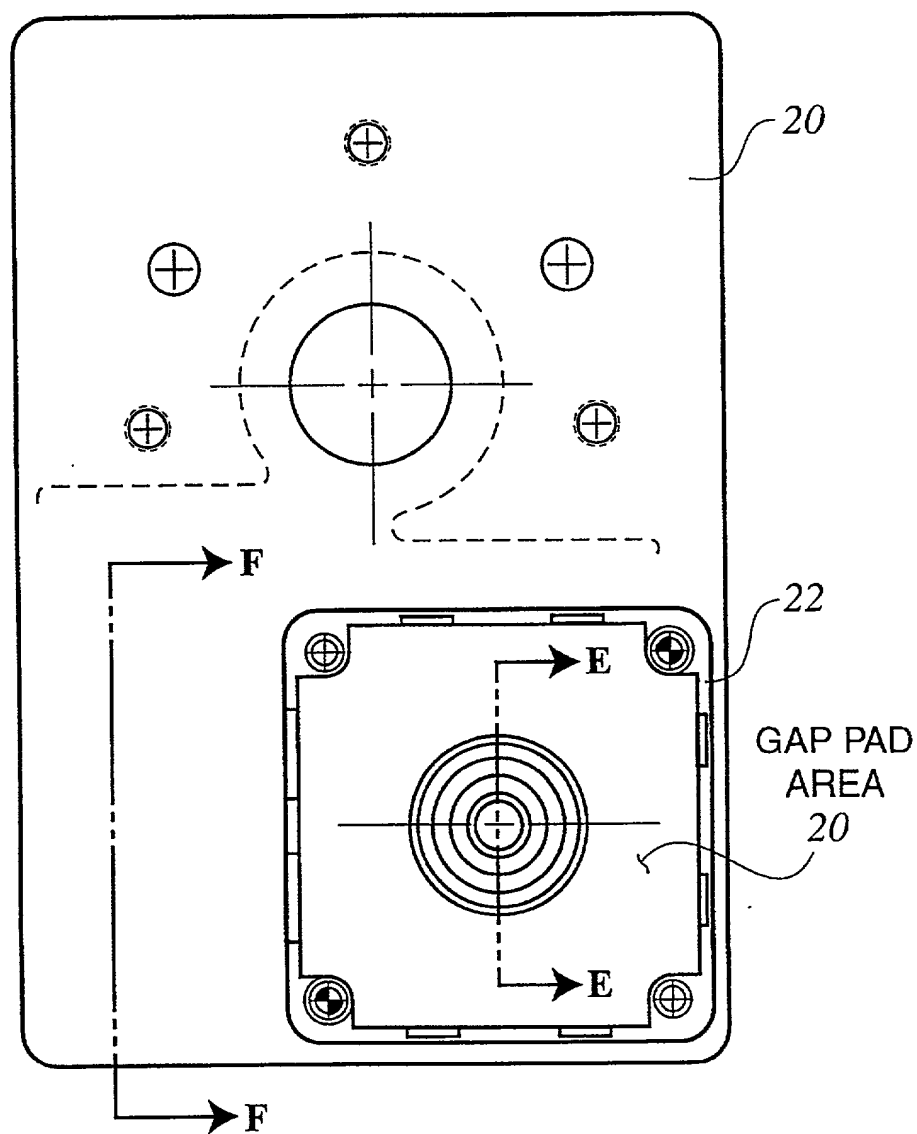
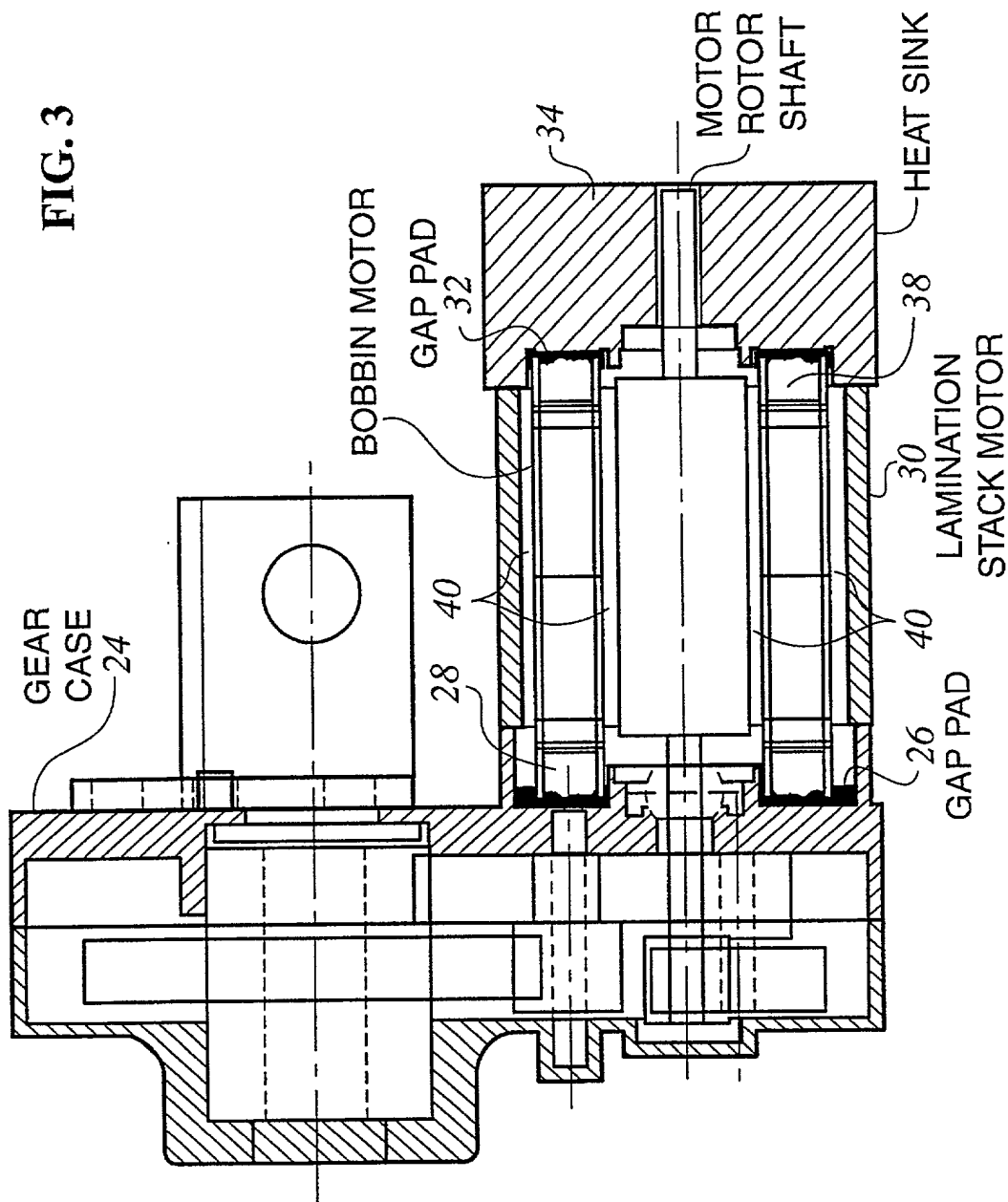


FIG. 2

FIG. 3



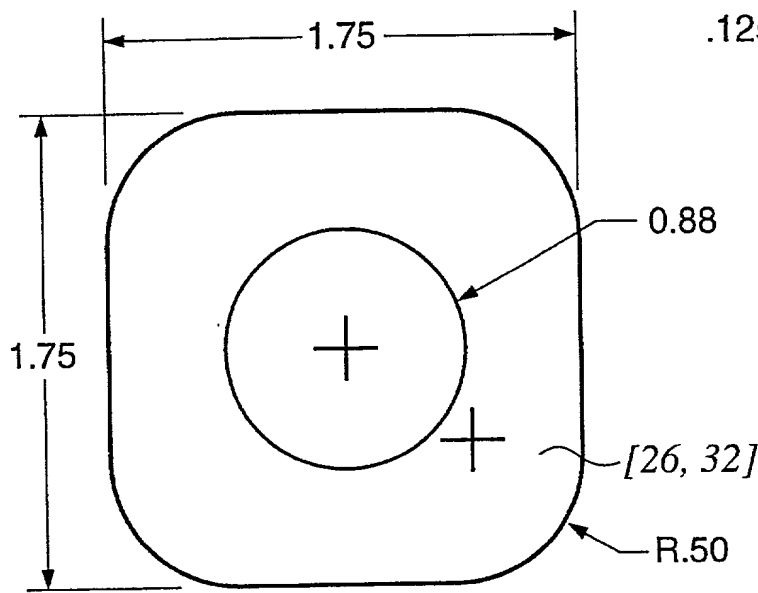


FIG. 4

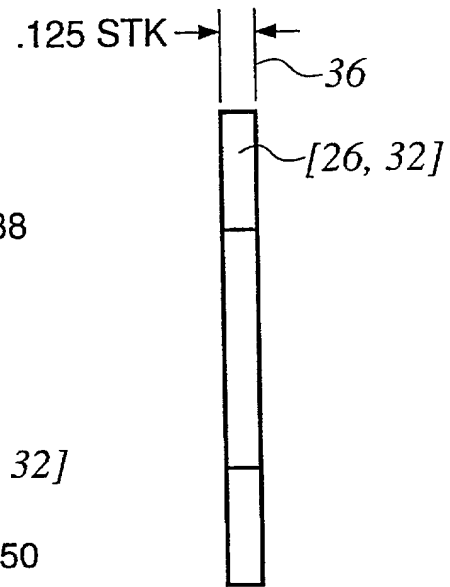


FIG. 5

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Approved for use through 9/30/98

Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE

PTO/SB/01 (8/96) DECLARATION Declaration OR Declaration <input checked="" type="checkbox"/> Submitted with <input type="checkbox"/> Submitted after Initial Filing Initial Filing	Attorney Docket Number	99920P (4497-40)
	First Named Inventor	Kenneth N. Whaley
	COMPLETE IF KNOWN	
	Application Number	
	Filing Date	
	Group Art Unit	
	Examiner Name	

As a below named inventor, I hereby declare that:

My residence, post office address, and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

HEAT BRIDGES FOR ELECTRIC MOTOR WITH GEAR CASE

(Title of the Invention)

the specification of which

☐ is attached hereto

OR

☒ was filed on (MM/DD/YYYY) 05 December 2000 as United States Application Number or PCT International

Application Number PCT/US00/32933 was amended on (MM/DD/YYYY)

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment specifically referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37 Code of Federal Regulations, §1.56.

I hereby claim foreign priority benefits under Title 35, United States Code §119(a)-(d) or §365(b) of any foreign application(s) for patent or inventor's certificate, or §365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or of any PCT international application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application Number(s)	Country		Priority Not Claimed	Copy Attached?	
				YES	NO
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

☐ Additional foreign application numbers are listed on a supplemental priority sheet attached hereto:

I hereby claim the benefit under Title 35, United States Code §119(e) of any United States provisional application(s) listed below.

Application Number(s)	Filing Date (MM/DD/YYYY)	Additional provisional Application numbers are listed on a supplemental priority sheet attached hereto.
60/169,542	12/07/1999	

Type a plus sign (+) inside this box [+]

DECLARATION			
I hereby claim the benefit under Title 35, United States Code §120 of any United States application(s), or §365(c) of any PCT international application designating the United States of America, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of Title 35, United States Code §112. I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations §1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application.			
U.S. Parent Application Number	PCT Parent Number	Parent Filing Date (MM/DD/YYYY)	Parent Patent Number (if applicable)
	PCT/US00/33944	12/05/2000	
<input checked="" type="checkbox"/> Additional U.S. or PCT international application numbers are listed on a supplemental priority sheet attached hereto.			
As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith:			
Name	Registration Number	Name	Registration Number
Terrance (Terry) Martin	30,291	Joseph J. Lockman, Jr.	25,058
Jules Jay Morris	30,873	Joseph D. Kuborn	40,689
Christine Rinik	33,763		
David Barron	39,598		
Jonathan Wainer	36,712		
John M. England, Jr.	34,813		
<input checked="" type="checkbox"/> Additional attorney(s) and/or agent(s) named on a supplemental sheet attached hereto.			
<input checked="" type="checkbox"/> Please direct all correspondence to:		Name Joseph D. Kuborn	
Address Andrus, Scales, Starke & Sawall, LLP			
Address 100 East Wisconsin Avenue, Suite 1100			
City Milwaukee	State Wisconsin	Zip 53202-4178	
Country United States	Telephone (414) 271-7590	Fax (414) 271-5770	
I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under §1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.			
Name of Sole or First Inventor: <input type="checkbox"/> A petition has been filed for this unsigned inventor			
Given Name Kenneth	Middle Initial N.	Family Name Whaley	
Inventor's Signature <i>Kenneth N. Whaley</i>	Date 8-6-01		
RESIDENCE: City Franklin	State WI	Country USA	Citizenship USA
POST OFFICE ADDRESS 9237 West Forrest Hill Avenue			
City Franklin	State WI	Zip 53132	Country USA
<input type="checkbox"/> Additional inventors are being named on supplemental sheet(s) attached hereto.			